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Cupping therapy for acute and chronic pain management: a systematic review of randomized clinical trials

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Abstract *Objective:* Cupping as a traditional therapy is used to treat a myriad of health conditions, including pain. This systematic review assessed the effectiveness and safety of cupping for different types of pain.
Methods: Thirteen databases and four trial registries were searched for randomized clinical trials. Meta-analysis of data was conducted if there was non-significant clinical and statistical heterogeneity (measured by I^2 test) among trials.
Results: Sixteen trials with 921 participants were eligible and included. Six trials were assessed as low risk of bias, another six trials were of unclear risk of bias, and the remaining four trials were of high risk of bias. Pain was related to three acute and seven chronic diseases. Meta-analysis showed a beneficial effect of cupping compared to wait-list control (visual analogue scale (VAS), MD −1.85 cm, 95%CI −2.66 to −1.04) and heat therapy (numerical rating scale, MD −2.05 cm, 95%CI −2.93 to −1.17). Cupping combined with acupuncture was superior to acupuncture alone on post-treatment pain intensity (VAS, MD −1.18 cm, 95%CI −1.68 to −0.68), however, no difference was found between this comparison based on changes in pain intensity (difference of VAS, MD 0.16 cm, 95%CI −0.54 to 0.87). Results from other single studies showed significant benefit of cupping compared with conventional drugs or usual care.

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Hematoma and pain at the treated site, increasing local pain or tingling were reported as mild adverse effects of cupping.
Conclusion: This review suggests a potential positive short-term effect of cupping therapy on reducing pain intensity compared with no treatment, heat therapy, usual care, or conventional drugs.

Introduction

Most people suffer serious pain at some stage of their lives. Nearly 80% of all visits to general practice involve at least one complaint directly related to pain, and 75% of Americans have experienced chronic or recurrent pain, costing $200 billion annually.[1] While pain is often prophylactic to further injury, appropriate pain management is also recognized as a fundamental human right and integral to good patient care.[2]

Pain can be classified physiologically as skeletal, neuropathic, or inflammatory[3]; or be classified by type of tissue involved, such as skin, muscle, viscera, joint and bone; or related to disease/condition, such as cancer, fibromyalgia; or may reflect psychologic states, age, gender, and culture. However, most guidelines and organizations, including the latest International Classification of Disease,[4] fundamentally classify pain as either acute or chronic as the initial stage of categorization.

Traditional Chinese medicine (TCM) has been used to treat pain for more than 2000 years, which holds that pain is mainly caused by disorder (insufficiency or disturbance) of *qi* (energy) and blood circulation, causing blood stasis or *qi* blockage in the organs, energy channels, and other parts of the body.[5]

Cupping therapy is a TCM healing modality that has been applied in Asia, particularly in China, as well as northern Europe (Scandinavia).[6] Cups can be made of different materials such as bamboo, glass, or earthenware. During treatment the air inside the cups is first rarefied to create a partial vacuum, which can be accomplished by various means such as heat or vacuum apparatus. The cups are then applied on the skin over prescribed acupuncture points. The resulting effect is local hyperemia or homeostasis as treatment for a specific disease.[7]

There are seven major types of cupping techniques in China.[8] Dry cupping is the most commonly used type, which uses the flaming heating power to achieve suction, then wet cupping (use blood-letting on the tender point before suction), moving cupping (move the cup towards one direction), flash cupping (remove the cups after suction without delay), et al. Different techniques are applied for different purposes of treatment. The principle of cupping treatment is to regulate and promote movement of *qi* and blood.[9] By doing so, cupping is able to alleviate pain, caused by blood stasis and *qi* blockage. Cupping may also accelerate microcirculation and relieve muscular spasm.[10]

A previous review of the efficacy of cupping therapy was conducted in 2010,[8] among the top 20 diseases/conditions in that review, 12 ailments involving 342 studies were related to pain. In the update review which published in 2012,[11] nearly all 135 included trials were reported as high risk of bias for their methodological quality. In addition, only one systematic review of seven studies assessed the effect of cupping for pain conditions, including cancer pain, low back pain, trigeminal neuralgia, et al.[12] Though evidence from these studies was positive, the number of studies and total sample size were too small for the authors to draw a firm conclusion. Thus, considering the large number of cupping trials and the uncertainty of its therapeutic effect, this review re-evaluates cupping therapy for pain management to reflect current research evidence.

Methods

The protocol of this review was registered and published at PROSPERO (CRD42013006756), accessible at: http://www.crd.york.ac.uk/PROSPERO/display_record.asp?ID=CRD42013006756.

Criteria for considering studies for this review

Studies considered for inclusion were parallel-group randomized controlled trials (RCTs) that used any form of cupping (dry cupping, wet cupping, flash cupping, moving cupping, medicinal cupping, needling cupping, or water cupping) compared with no treatment or other active therapies. Participants had to be 18 years or older and could be of any gender. Pain conditions, known or idiopathic, including musculoskeletal pain, neurologic pain, or pain caused by infection or other disease with at least moderate pain (e.g. baseline visual analog scale, or VAS, pain intensity score in excess of 3 cm) were included. Comparisons also included a combination of cupping therapy plus other therapies versus other therapies alone. Trials used combined therapy employing cupping therapy with other TCM therapy (such as acupuncture or herbal medicine) compared with other interventions were excluded. We contacted authors to confirm their randomization methods. Trials that used inappropriate or spurious randomization or trials that authors were unable to provide information on randomization methodology were excluded.

Primary outcomes included: patient-reported pain intensity, which was assessed qualitatively or quantitatively through any type of pain severity score (e.g. VAS) and tender point counts for certain diseases, such as fibromyalgia; patient-reported pain episodes; numbers of patients who had at least 50% of maximum possible pain relief over baseline; and number of patients who had at least 30% of

maximum possible pain relief over baseline. Secondary outcomes included: patient or provider global evaluation; psychosocial function outcomes, such as the Hamilton Depression Scale; quality of life (QoL), such as SF-36; and adverse effects, which was assessed by reporting early study discontinuations, worsening of pain, and other adverse events during the treatment and follow-up periods.

Literature search

We identified all relevant RCTs regardless of language or publication status (published, unpublished, in-press, or in-progress). Nine English databases and four Chinese databases were searched from inception to December 2013, including the Cochrane Central Register of Controlled Trials (CENTRAL), PubMed, EMBASE, Cumulative Index of Nursing and Allied Health Literature (CINAHL), Scopus, Science Direction, Biomed Central, Current Content, Health and Medical Complete, China Network Knowledge Infrastructure (CNKI), Chinese Scientific Journals Database (VIP), Wan Fang Database (for unpublished graduate theses in China), and Chinese Biomedicine (CBM).

We also searched ongoing trials from the metaRegister of Controlled Trials, the U.S. National Institutes of Health Ongoing Trials Register, the Australian New Zealand Clinical Trials Registry, and the World Health Organization International Clinical Trials Registry Platform. Reference lists of all relevant papers found electronically were also searched.

Search terms included "pain" or "analgesic*", which was combined with "cup*", "cupping", or "suction".

Data collection and extraction

Two authors (XY and XL) evaluated the titles and abstracts independently. Full papers were retrieved for all potentially relevant studies. Disagreements were resolved by discussion and if needed, arbitrated by a third author (HJC).

Two authors (HJC and XL) extracted the data from the included studies independently. Disagreements were settled by discussion with a third author (JPL). Extracted information included study methods (design, randomization method, blinding method), characteristics of participants (inclusion/exclusion criteria, sample size, gender, age, type of disease/condition, duration of pain, previous treatments), details of intervention and control (type of cupping, selection of acupoints, frequency and duration of treatment, type of control, details of co-interventions), follow-up data (duration of follow-up, withdrawal rates and reasons), outcomes data, and data analysis (methods of analysis, comparability of groups at baseline, statistical techniques).

Assessment of risk of bias in included studies

We applied the assessment of risk of bias provided by the *Cochrane Handbook for Systematic Reviews of Interventions*[13] to generate a risk of bias assessment table for each study. Categories of selection bias, performance bias, detection bias, attrition bias, reporting bias, and other biases were assessed. There were three potential bias judgments: "low risk", "high risk", or "unclear risk". If a study had insufficient methodological details, judgment of the study was deemed "unclear". An "unclear" judgment was also made when what occurred in the study was known but the risk of bias was unknown or when an item was not relevant to the study at hand, particularly for assessing blinding and incomplete outcome data, or when the outcome was assessed by the item which had not been measured in the study.

Data analysis

Statistical analyses were accomplished with Review Manager 5.2, the Cochrane statistical package (available from ims.cochrane.org/revman/download). One author (XL) was responsible for entering data into the software. Data entry was checked by a second author (HJC). Data were summarized using risk ratios (RR) with 95% confidence intervals (CI) for binary outcomes or mean difference (MD) with 95% CI for continuous outcomes. When needed, authors of included trials were contacted to obtain missing information.

Meta-analysis was used for studies when the I^2 statistic was less than 75%. A random-effects model was used unless the degree of heterogeneity was readily explainable or when the measure of heterogeneity I^2 statistic was less than 25%, in which case, the fixed-effect model was used.[13]

If data permitted, we planned to conduct subgroup analyses with a minimum of two trials for different groups split by age, gender, disease, or pain severity. If available, we would perform sensitive analysis regarding "study size," when only studies with at least two groups and 100 participants per group were included.

Summary of finding (SOF) tables were generated using GRADE Pro software (version 3.2 for Windows). The SOF table evaluated the overall quality of the body of evidence for pain relief using GRADE Working Group criteria (study limitations, consistency of effect, imprecision, indirectness, and publication bias).

Results

Search results

Our search strategy (Fig. 1) identified a total of 55 out of 2298 citations from 13 databases and 4 trial registrations assessing the effects of cupping on pain outcomes. After full text reading, only 16 studies met our inclusion criteria. Two trial abstracts[14,15] were counted as studies awaiting classification, as these authors did not respond to requests for additional information, thus data from these two completed but unpublished clinical trials could not be included in this review.

Characteristics of included trials

Sixteen trials with a total of 921 participants (average 28 per group) were included (Table 1). Males accounted for 41.26% of the participants. Eight trials were conducted in China and published in Chinese,[16,19,25,26,28–31] the remaining 8 trials were published in English,[17,18,20–24,27] among which 5 studies

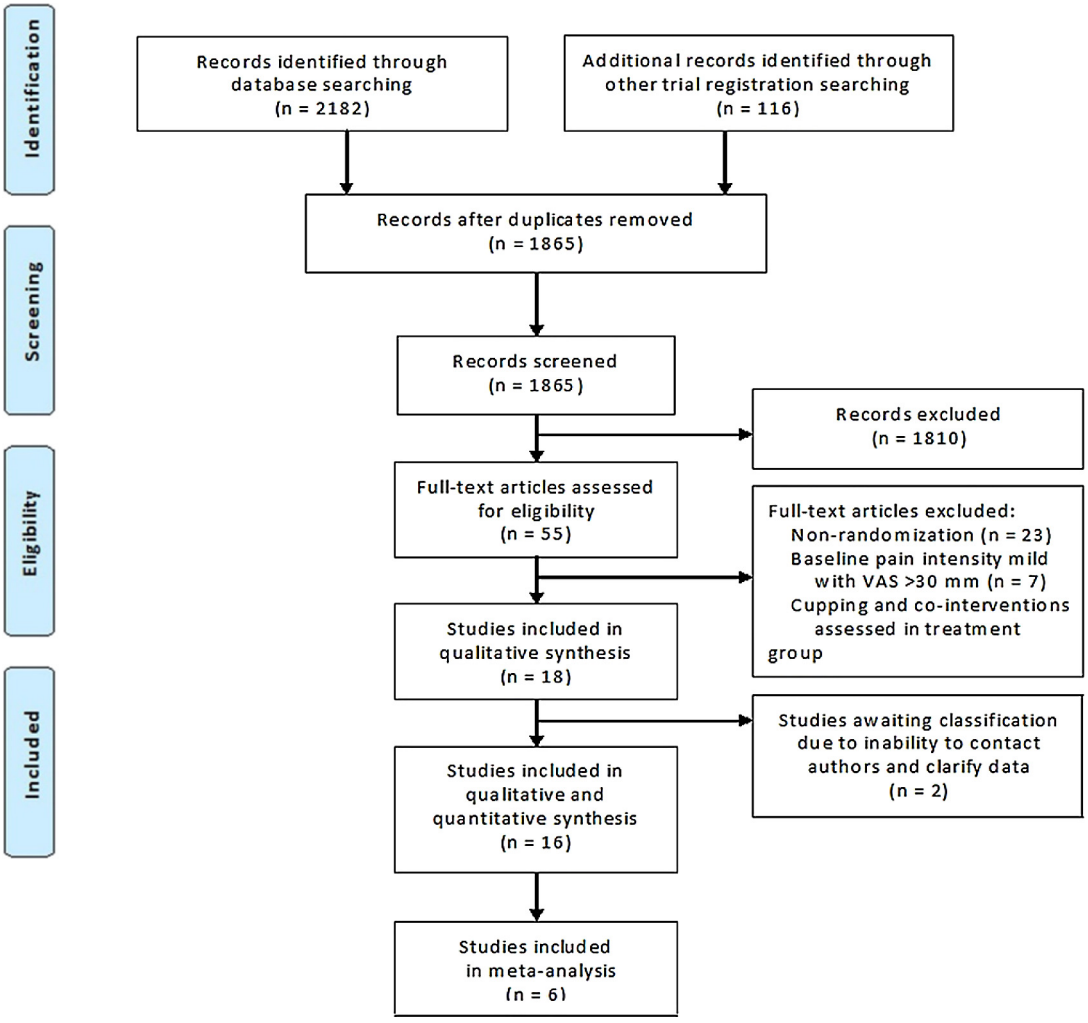

Figure 1 Study flow diagram.

were conducted in Germany,[17,22–24,27] 2 in Korea,[20,21] and 1 in Iran.[18] Targeted diseases included chronic neck pain (4 trials),[17,21–23] non-specific low back pain (2 trials),[18,20] herpes zoster (2 trials),[29,31] osteoarthritis (2 trials),[27,28] shoulder pain (1 trial),[25] postapoplectic shoulder-hand syndrome (1 trial),[19] scapulohumeral periarthritis (1 trial),[16] carpal tunnel syndrome (1 trial),[24] acute ankle sprain (1 trial),[30] and headache (1 trial).[26]

Among the 16 trials, wet cupping was assessed in 11 trials,[16,18–21,24–26,28,30,31] dry cupping in 2 trials,[22,27] moving cupping,[23] medicinal cupping,[30] and combined dry and moving cupping[17] were assessed in 1 trial each. Comparisons included cupping versus wait-list control,[22,24,27,30] cupping versus other treatment (usual care, heat therapy, muscle relaxation, or exercise),[17,18,21,23,29] cupping versus medications (flunarizine 10 mg daily for headache, diclofenac 100 mg daily for osteoarthritis, or mecobalamin injection 0.5 mg daily for herpes zoster),[26,28,29] and cupping plus other treatments (acupuncture, exercise, or medications) versus other treatments alone.[16,19,20,25,31]

All trials reported one of our pre-defined primary outcomes — pain intensity, which was measured by either VAS, numerical rating scale (NRS), present pain intensity (PPI), McGill Pain Questionnaire (MPQ), or short-form MPQ (SF-MPQ). No trial reported tender point counts, patient-reported episodes of pain, or numbers of patients who had at least 30% or 50% of maximum pain relief over baseline. QoL measured by SF-36 was reported in 5 trials,[17,22–24,27] and adverse events were described in 10 trials.[17,20–24,26,27,29,30]

Risk of bias in included studies

Risk of bias was evaluated for different categories (Fig. 2). All 16 trials were assessed as "low risk of bias" on random sequence generation items. Methods of random sequence generation included central randomization (1 trial),[31] random number table (9 trials),[16,18,19,23–26,28,29] and computer software (6 trials).[17,20–22,27,30] Thirteen trials had "low risk" of selection bias, of which 12 trials employed sealed opaque envelopes[17,18,20–25,27–30] and the remaining trial used central randomization to perform allocation concealment.[31] No trial applied blinding of participants and practitioners. The primary outcome of the included trials was pain intensity assessment, a subjective measure performed by participants themselves. For this reason, we assessed all 16 trials as "high risk" of performance bias.

Table 1 Characteristics of 16 included trials.

Study ID	Participants (T: Treatment; C: Control)	Intervention	Control	Treatment duration	Outcome measurements
Chen 2009[5]	Condition: Scapulohumeral periarthritis Gender (male/female): T 16/14; C 15/13 Age (yrs, MD ± SD): T 52 ± 1.6; C 53 ± 1.3 Pain intensity at baseline (VAS, cm): T 4.63 ± 1.42; C 4.63 ± 1.42	Wet cupping: Tapping with plum-blossom needles on *ashi* points around shoulder joint until bleeding; cups applied and retained on *ashi* points 10 min. Once every 2 days. Electro-acupuncture: Same as in control group.	Electro-acupuncture: Needles inserted at LI15, SJ14, SI9, GB21, Ex-UE, SI11, LI11; after *deqi*, needles connected to electric stimulator for 30 min. Once daily.	60 days	VAS, frequency of pain, voluntary movement of shoulder joint
Cramer 2011[8]	Condition: Chronic neck pain Gender (male/female): T 4/20; C 6/18 Age (yrs, MD ± SD): T 44.5 ± 10.8; C 47.9 ± 13.5 Pain intensity at baseline (NRS, cm): T 4.12 ± 1.45; C 4.20 ± 1.57	Moving and dry cupping: Arnica oil massaged onto neck and shoulder; glass cup applied on the skin and glided over the painful region in sweeping movements for 10—15 min, then 4 cups applied and retained over the trapezius muscle for 5—10 min. Once every 3—4 days.	Usual care: Participants continued self-directed standard medical care (physical therapy, exercise, analgesics) with general practitioner or orthopaedist.	14 days	AE, NDI, NRS, SF-36, VAS
Farhadi 2009[9]	Condition: Non-specific low back pain Gender (male/female): T 30/18; C 37/13 Age (yrs, MD ± SD): T 44.9 ± 14.8; C 41.8 ± 13.9 Pain intensity at baseline (PPI): T 2.7 ± 0.8; C 2.7 ± 0.9	Wet cupping: Sites between 2 scapulas at T1—T3 level on day 0; between lumbar vertebrae and coccyx on day 3; over center of gastrocnemius on day 6. At each treatment session: Cups applied and retained 3—5 min, then removed; multiple superficial incisions made with surgical blade; cup re-applied and retained 3—5 min until filled with blood. Procedure done 3 times.	Usual care: 1) early return to usual activities encouraged, excluding heavy manual labor; 2) activity change to minimize symptoms; 3) acetaminophen or NSAIDs; 4) short duration muscle relaxants or opioids; 5) bed rest, not more than 2 days; 6) spinal manipulation.	6 days	MQS III, PPI, ODI
Fu 2009[10]	Condition: Post-apoplectic shoulder-hand syndrome Gender (male/female): T 24/16; C 22/18 Age (yrs, MD ± SD): T 63 ± 2; C 63.9 ± 15.2	Acupuncture: Needles inserted at *ashi* points, LI15, SJ14, LI4, LI10, LI11, LI14 for 30 min, once daily. Wet cupping: Puncture *ashi*, LI15, SJ14, LI11 with tri-	Acupuncture: Same as in treatment group. Stroke therapy: Usual care and medications, herbal medicine, acupuncture, physical rehabilitation, and patient	30 days	VAS, frequency of pain, voluntary activity of shoulder joint, effectiveness rate

(*continued on next page*)

Table 1 (*continued*)

Study ID	Participants (T: Treatment; C: Control)	Intervention	Control	Treatment duration	Outcome measurements
	Pain intensity at baseline (VAS, cm): T 5.26 ± 1.23; C 4.98 ± 1.54	ensiform needle; cups applied and retained until 2—5 ml blood is let. Once daily. Stroke unit therapy: Same as in control group.	education.		
Kim 2011[15]	Condition: Non-specific low back pain Gender (male/female): T 5/16; C 3/8 Age (yrs, MD ± SD): T 44.2 ± 9.4; C 48 ± 5.4 Pain intensity at baseline (NRS, cm): T 5.81 ± 1.12; C 5.27 ± 0.80	Wet cupping: Bilateral BL23, BL24, BL25 punctured with acupuncture needle to 2 mm depth; cups applied and retained for 5 min. Three times weekly. Exercise: Same as in control group.	Wait-list Exercise: 8 types of stretching and strengthening exercises.	14 days	AE, NRS, ODI, PPI, number of acetaminophen tablets used
Kim 2012[17]	Condition: Neck pain Gender (male/female): T 7/13; C 11/9 Age (yrs, MD, range): T 25.5 (22.5—40.5); C 28 (25—31.5) Pain intensity at baseline (NRS, cm): T 5.93 ± 1.63; C 6.49 ± 1.49	Wet cupping: 6—10 tender points on posterior neck, upper trapezius, and perispinal area of the neck and thoracic spine were punctured 6 times with acupuncture needle to 2 mm depth until 3—5 ml of blood were let; cups applied and retained for 5—10 min. Three times weekly.	Heat therapy: Hot water bottle applied to neck and upper trapezius for 10 min, three times weekly.	14 days	AE, cervical spine range of motion, EQ-5D, MYMOP2, NDI, NRS, SRI-SF, FSS
Lauche 2011[18]	Condition: Non-specific neck pain Gender (male/female): T 7/15; C 4/20 Age (yrs, MD ± SD): T 48.6 ± 11.2; C 53.0 ± 11.4 Pain intensity at baseline (VAS, cm): T 4.55 ± 2.09; C 4.23 ± 1.80	Dry cupping: Cups retained on affected areas for 10—20 min. Treatment every 3—4 days.	Wait-list	25 days	AE, MDT, NDI, NRS, SF-36, PD, PM, PPT, PR, VAS, VDT
Lauche 2013[19]	Condition: Chronic neck pain Gender (male/female): T 6/24; C 10/21 Age (yrs, MD ± SD): T 54.5 ± 12.3; C 53.7 ± 13.4 Pain intensity at baseline (VAS, cm): T 5.58 ± 1.97;C 5.63 ± 1.86	Moving cupping: cupping massage with arnica massage oil, 10—15 min twice weekly.	Progressive muscle relaxation: participants asked to practice relaxation for 20 min at home twice weekly.	84 days	AE, FEW-16, GKÜ, PD, PPT, PSQ-20, VAS, pain perception scale, NDI, HADS SF-36

Table 1 (*continued*)

Study ID	Participants (T: Treatment; C: Control)	Intervention	Control	Treatment duration	Outcome measurements
Michalsen 2009[21]	Condition: Carpal tunnel syndrome Gender (male/female): T 2/24; C 4/22 Age (yrs, MD ± SD): T 57.2 ± 7.7; C 59.3 ± 8.3 Pain intensity at baseline (VAS, cm): T 6.15 ± 2.49; C 5.86 ± 2.51	Wet cupping: Skin over trapezius punctured repeatedly with microlancet; cups applied and retained for 5—10 min or removed when partially filled with blood. Single treatment.	Heat therapy: Heating pad applied for 15 min to shoulder areas bilaterally with participant in supine position. Single treatment.	1 session	AE, VAS, DASH, Levine-CTSQ, SF-36,
Ouyang 2001[22]	Condition: Shoulder pain Gender (male/female): T 18/8; C 22/8 Age (yrs, MD, range): T 58.2 (27—75); C 56.8 (29—71) Pain intensity at baseline (VAS, cm): T 6.37 ± 3.22; C 6.25 ± 3.01	Wet cupping: *Ashi* points around shoulder joint punctured first; cups applied and retained for 10 min. Once every 2 days. Physical rehabilitation: Same as in control group.	Physical rehabilitation: Routine rehabilitation 30 min once daily.	30 days	Brunnstrom Grade, frequency of pain, VAS
Song 2013[23]	Condition: Headache (blood-stasis syndrome) Gender (male/female): T 16/29; C 8/27 Age (yrs, MD ± SD): T 35.4 ± 3.1; C 36.1 ± 2.3 Pain intensity at baseline (VAS, cm): T 6.76 ± 1.48; C 6.44 ± 1.78	Wet cupping: Puncture *ashi* points, temple, G20, GV14 with lotus needle; cups applied and retained for 15 min. Twice weekly.	Drugs: Flunarizine 10 mg oral once daily at bedtime.	60 days	AE, effectiveness rate, onset time, VAS
Teut 2012[26]	Condition: Osteoarthritis Gender (male/female): T 5/16; C 8/11 Age (yrs, MD ± SD): T 68.1 ± 7.2; C 69.3 ± 6.8 Pain intensity at baseline (VAS, cm): T 6.02 ± 1.22; C 5.79 ± 0.80	Dry cupping: Pulsatile cupping administered by a mechanical cupping device with flexible silicone cups to the knee joint for 10 min and plastic cups applied bilaterally to lower back for 5 min. Twice weekly. Paracetamol on demand with maximum dosage of 2 g daily.	Wait-list Paracetamol on demand with maximum dosage of 2 g daily.	28 days	AE, SF-36, VAS, WOMAC

(*continued on next page*)

Table 1 (*continued*)

Study ID	Participants (T: Treatment; C: Control)	Intervention	Control	Treatment duration	Outcome measurements
Wu K 2013[29]	Condition: Osteoarthritis Gender (male/female): T 8/22; C 7/23 Age (yrs, MD ± SD): T 56.7 ± 6.6; C 57.4 ± 5.8 Pain intensity at baseline (VAS, cm): T 6.97 ± 0.85; C 7.00 ± 0.87	Wet cupping: Acupuncture needles inserted 3—4 mm at Ex-LE4, Ex-LE5, ST34, SP10, SP9, and *ashi* points; cups applied and retained 3—4 min. Once every 2 days.	Drugs: Diclofenac 50 mg twice daily.	14 days	Effectiveness rate, VAS, WOMAC
Wu X 2013[30]	Condition: Herpes zoster neuralgia Gender (male/female): T 12/7; C1 10/9; C2 10/9 Age (yrs, MD ± SD): T 63 ± 10; C1 63 ± 9; C2 68 ± 7 Pain intensity at baseline (SF-MPQ): T 23.95 ± 3.25; C1 23.21 ± 5.12; C2 22.68 ± 2.91	Medicinal cupping: Bamboo cups boiled in herbal decoction for 2 min; herbs comprised of Suberect Spatholobus Stem 30 g, Fructus Liquidambaris 30 g, Rhizoma Gastrodiae 15 g, Rhizoma Chuanxiong 20 g, Herba Asaricum Radice 15 g, Areca Peel 30 g, Morus Alba Corticis 30 g, Frankincense 20 g, Myrrh 20 g; cups applied on *ashi* points for 5 min. Once daily. Drugs: Ibuprofen 0.3 g twice daily.	C1-Heat therapy: 40 cm × 40 cm towel dipped in boiling herbal decoction (same prescription as treatment group) and applied on *ashi* points for 5 min. Once daily. Ibuprofen 0.3 g twice daily. C2-Drugs: Mecobalamine injection 0.5 mg injection once daily plus ibuprofen 0.3 g twice daily	14 days	AE, effectiveness rate, SF-MPQ (VAS, PPI, PRI)
Wu 2007[31]	Condition: Acute ankle sprain Gender (male/female): T 10/21; C 11/19 Age (yrs, MD ± SD): Not reported Pain intensity at baseline (VAS, cm): T 8.61 ± 1.06; C 8.74 ± 0.92	Wet cupping: Affected area punctured with bloodletting needle; cups applied and retained for 10 min. Once daily.	Wait-list	5 days	AE, degree of swelling, effectiveness rate, function activity, VAS
Zhang 2009[32]	Condition: Herpes zoster Gender (male/female): T 10/15; C 12/13 Age (yrs, range): T 18—66; C 19—67 Pain intensity at baseline (VAS, cm): Not reported	Wet cupping: Tapping with plum-blossom needles on *ashi* points; cups applied and retained on *ashi* points for 5—10 min. Once daily. Electro-acupuncture: Same as in control group.	Electro-acupuncture: Needles inserted at *ashi* points, Jiaji points, TE6, SI3; needles at TE6 and SI3 attached to electric stimulator for 30 min. Once daily.	10 days	Effectiveness rate, VAS

Abbreviations: AE = adverse events; DASH = Disabilities of the Arm, Shoulder and Hand; EQ-5D = EuroQol Health Index; FEW-16 = Questionnaire on the Assessment of Physical Wellbeing; FSS = Fatigue Severity Scale; GKÜ = Health Related Control Beliefs; HADS = Hospital Anxiety and Depression Scale; Levine-CTSQ = Levine carpal tunnel syndrome questionnaire; MDT = mechanical-detection thresholds; MQS III = Medication Quantification Scale version III; MYMOP2 = Measure Yourself Medical Outcome Profile; NDI = Neck Disability Index; NRS = numeric rating scale; ODI = Oswetry Disability Index; PD = pain diary; PM = maximal pain related to movement; PPI = present pain intensity scale; PPT = pressure pain thresholds; PR = pain at rest; PSQ-20 = Perceived Stress Questionnaire; SF-MPQ = Short-Form McGill Pain Questionnaire; SRI-SF = short form stress response inventory; VAS = visual analog scale; VDT = vibration detection thresholds; WOMAC = Western Ontario and McMasters Universities Osteoarthritis Index.

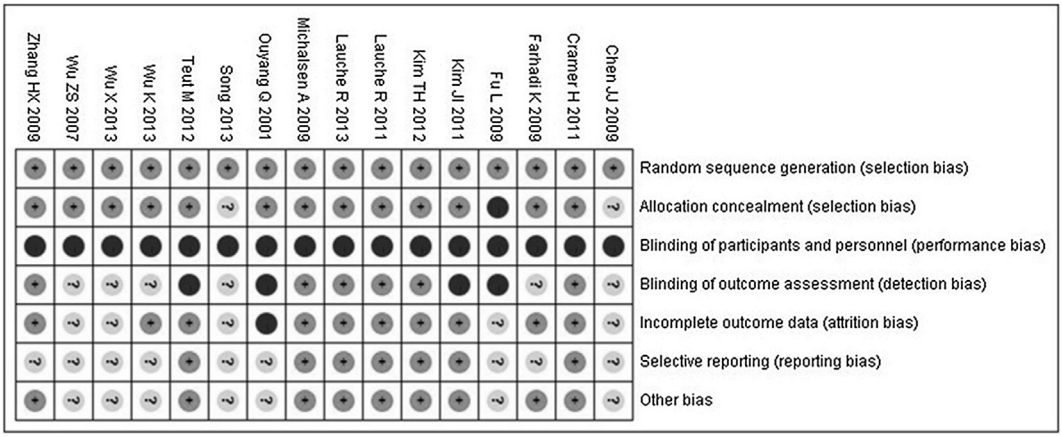

Figure 2 Risk of bias summary review authors' judgments about each risk of bias item for each included study.

Blinding of outcome assessors or statisticians was carried out in 6 trials with "low risk of bias" for this item.[17,21–24,31] Four trials reported as "open label study" in their protocol did not use blinding methods at all and were assessed as "high risk" of detection bias.[19,20,25,27] One trial that did not apply an appropriate statistical method in addressing missing data was evaluated as "high risk" of attrition bias.[25] Considering the difficulty of blinding of participants and practitioners in cupping studies, the overall quality of 5 included trials[17,21–24] were defined as "low risk of bias", in which only performance bias was unavoidable. Four trials, which had more than one item with high risk of bias, were evaluated as overall "high risk of bias".[19,20,25,27] The remaining 7 trials were evaluated as "unclear risk of bias" for overall methodological quality.[16,18,26,28–31]

Effects of interventions

Estimate effect of cupping therapy for pain management from 16 included trials was evaluated (Table 2). Despite variation in diseases/conditions among the included trials, the principal aim of all 16 trials was to relieve pain. Therefore, change in pain intensity post-treatment was the primary outcome in all trials. Based on this, we decided to perform data pooling on the primary outcomes although there was variation in disease/conditions.

For primary outcomes, pain intensity was measured by VAS, NRS, PPI, or SF-MPQ in the trials. Due to similarity of the VAS and NRS scales (pain intensity weighted from 0 to 10 cm/100 mm), trials that used these two measurement scales were considered similar for the purposes of outcome assessment. However, to render the two scales comparable, data (both MD and SD) of different trials were converted from a scale of 0–100 mm into 0–10 cm, dividing by 10. For secondary outcomes, QoL was measured by SF-36 in 5 trials. Total scores for mental domain and physical domain were analyzed separately for those trials.

Cupping therapy versus wait-list control

Three trials compared cupping therapy to wait-list control group[22,27,30] (Table 2). Meta-analysis of 2 trials[22,27] showed 4 weeks' dry cupping therapy produced better effect on reducing pain (VAS, MD −1.85 cm, 95%CI −2.66 to −1.04, $P < 0.00001$, $I^2 = 0\%$, P value for heterogeneity = 0.60, fixed model, 2 trials, 86 participants), and on improving QoL (SF-36 mental scores, MD 5.90, 95%CI 0.16 to 11.64, $P = 0.04$, $I^2 = 50\%$, P value for heterogeneity = 0.16, random model; SF-36 physical scores, MD 3.77, 95%CI 1.27 to 6.26, $P = 0.003$, $I^2 = 0\%$, P value for heterogeneity = 0.78, fixed model, 2 trials, 86 participants). The remaining trial[30] also showed significant effect of wet cupping therapy for pain reduction (VAS, MD −7.07 cm, 95%CI −7.45 to −6.69, $P < 0.00001$, 61 participants).

Cupping therapy versus conventional medications

Three trials compared wet cupping therapy to western drugs[26,28,29] (Table 2). Due to the different types of medications used in the control groups among these 3 trials, meta-analysis was not conducted. However, each of these trials found wet cupping was superior to conventional drugs (mecobalamin injection, diclofenac after 2 weeks' treatment, or flunarizine after 2 months' treatment) for pain reduction.

Cupping therapy versus other comprehensive treatment

Six trials used comparisons between cupping therapy and other comprehensive treatment, including usual care (exercise, bed rest, or analgesics), heat therapy, and progressive muscle relaxation[17,18,21,23,24,29] (Table 2). Meta-analysis of 2 trials showed significant difference between wet cupping therapy and heat therapy on reducing pain (NRS, MD −2.05 cm, 95%CI −2.93 to −1.17, $P < 0.00001$, $I^2 = 0\%$, P value for heterogeneity = 0.82, fixed model, 2 trials, 92 participants) after 1–2 weeks' treatment.[21,24] Another 2 trials also found that after 2 weeks' treatment wet cupping (PPI, MD −2.10, 95%CI −2.54 to −1.66, $P < 0.00001$, 98 participants)[18] and moving and dry cupping therapy (NRS, MD −1.72 cm, 95%CI −2.74 to −0.70, $P = 0.0009$, 48 participants)[17] was superior to usual care (including exercise, analgesics). However, the remaining 2 trials reported no difference between moving cupping and progressive muscle relaxation (VAS, MD −0.54 cm, 95%CI −1.90 to 0.82,

Table 2 Estimate effect of cupping for pain management (regardless of type of diseases) from 16 included trials.

Outcome or subgroup	Studies	Participants	Statistical method	Effect estimate	*P* value
Cupping therapy versus waiting list/no treatment					
Pain intensity measured by VAS	3		Mean Difference (IV, Fixed, 95% CI)	Subtotals only	
Dry cupping versus wait-list	2	86	Mean Difference (IV, Fixed, 95% CI)	−1.85 [−2.66, −1.04]	<0.00001
Wet cupping versus wait-list	1	61	Mean Difference (IV, Fixed, 95% CI)	−7.07 [−7.45, −6.69]	<0.00001
Quality of life measured by SF36-physical score	2	86	Mean Difference (IV, Fixed, 95% CI)	Subtotals only	
Dry cupping versus waiting list	2	86	Mean Difference (IV, Fixed, 95% CI)	3.77 [1.27, 6.26]	0.003
Quality of life measured by SF36-mental score	2	86	Mean Difference (IV, Random, 95% CI)	Subtotals only	
Dry cupping versus waiting list	2	86	Mean Difference (IV, Random, 95% CI)	5.90 [0.16, 11.64]	0.04
Cupping therapy versus conventional drugs					
Pain intensity measured by VAS	3		Mean Difference (IV, Fixed, 95% CI)	Subtotals only	
Wet cupping versus flunarizine	1	90	Mean Difference (IV, Fixed, 95% CI)	−1.40 [−2.08, −0.72]	<0.0001
Wet cupping versus diclofenac	1	60	Mean Difference (IV, Fixed, 95% CI)	−0.50 [−0.80, −0.20]	0.0009
Pain intensity measured by SF-MPQ	1		Mean Difference (IV, Fixed, 95% CI)	Subtotals only	
Medicinal cupping plus ibuprofen versus mecobalamin injection plus ibuprofen	1	38	Mean Difference (IV, Fixed, 95% CI)	−5.47 [−8.41, −2.53]	0.0003
Cupping therapy versus other treatment					
Pain intensity measured by VAS/NRS/PPI	5		Mean Difference (IV, Fixed, 95% CI)	Subtotals only	
Wet cupping versus usual care	1	98	Mean Difference (IV, Fixed, 95% CI)	−2.10 [−2.54, −1.66]	<0.00001
Wet cupping versus heat therapy	2	92	Mean Difference (IV, Fixed, 95% CI)	−2.05 [−2.93, −1.17]	<0.00001
Moving and dry cupping versus usual care	1	48	Mean Difference (IV, Fixed, 95% CI)	−1.72 [−2.74, −0.70]	0.0009
Moving cupping versus progressive muscle relaxation	1	61	Mean Difference (IV, Fixed, 95% CI)	−0.54 [−1.90, 0.82]	0.43
Pain intensity measured by SF-MPQ	1		Mean Difference (IV, Fixed, 95% CI)	Subtotals only	
Medicinal cupping plus ibuprofen versus medicinal heat therapy plus ibuprofen	1	38	Mean Difference (IV, Fixed, 95% CI)	−3.10 [−6.83, 0.63]	0.10
Quality of life measured by SF36-mental scores	2		Mean Difference (IV, Fixed, 95% CI)	Subtotals only	
Moving and dry cupping versus usual care	1	48	Mean Difference (IV, Fixed, 95% CI)	1.76 [−4.83, 8.35]	0.60
Moving cupping versus progressive muscle relaxation	1	61	Mean Difference (IV, Fixed, 95% CI)	−0.70 [−6.84, 5.44]	0.82
Quality of life measured by SF36-physical scores	2		Mean Difference (IV, Fixed, 95% CI)	Subtotals only	
Moving and dry cupping versus usual care	1	48	Mean Difference (IV, Fixed, 95% CI)	7.11 [2.59, 11.63]	0.002
Moving cupping versus progressive muscle relaxation	1	61	Mean Difference (IV, Fixed, 95% CI)	3.70 [−0.90, 8.30]	0.12
Cupping therapy plus other treatments versus other treatments alone					
Pain intensity measured by VAS/NRS	4		Mean Difference (IV, Fixed, 95% CI)	Subtotals only	
Wet cupping plus acupuncture versus acupuncture	2	138	Mean Difference (IV, Fixed, 95% CI)	−1.18 [−1.68, −0.68]	<0.00001
Wet cupping plus exercise versus exercise alone	1	56	Mean Difference (IV, Fixed, 95% CI)	−0.53 [−1.18, 0.12]	0.11
Wet cupping plus exercise/acetaminophen versus exercise/acetaminophen alone	1	32	Mean Difference (IV, Fixed, 95% CI)	−0.16 [−1.32, 1.00]	0.79
Difference in pain intensity measured by VAS	3		Mean Difference (IV, Random, 95% CI)	Subtotals only	
Wet cupping plus acupuncture versus acupuncture alone	2	82	Mean Difference (IV, Random, 95% CI)	0.16 [−0.54, 0.87]	0.65
Wet cupping plus exercise versus exercise alone	1	56	Mean Difference (IV, Random, 95% CI)	0.64 [0.07, 1.21]	0.03

Abbreviations: NRS = numeric rating scale; PPI = present pain intensity scale; SF-MPQ = Short-Form McGill Pain Questionnaire; VAS = visual analog scale.

$P = 0.43$, 61 participants)[23] after 12 weeks' treatment or between medicinal cupping and heat therapy (SF-MPQ, MD −3.10, 95%CI −6.83 to 0.63, $P = 0.10$, 38 participants)[29] after 2 weeks' treatment.

Two[17,23] of the 6 trials assessed QoL by SF-36. A significant difference was found in 1 trial[17] only between moving cupping therapy and usual care on improving QoL physical scores (MD 7.11, 95%CI 2.59 to 11.63, $P = 0.002$, 48 participants) after 2 weeks' treatment.

Cupping therapy plus other treatments versus other treatments alone

Comparisons between cupping therapy combined with other treatments and other treatments alone were assessed in five trials.[16,19,20,25,31] These treatments included acupuncture, exercise, and combination of exercise and acetaminophen. Meta-analysis of 2 trials found a significant difference between combinations of wet cupping plus acupuncture and acupuncture alone in relieving pain (VAS, MD −1.18 cm, 95% CI −1.68 to −0.68, $P < 0.00001$, $I^2 = 0\%$, P value for heterogeneity = 0.97, fixed model, 2 trials, 138 participants) after 1−2 months' treatment.[16,19] One trial found the combination of wet cupping and exercise was superior to exercise alone[25] on pain reduction as revealed by the difference in VAS from baseline to post-treatment (MD 0.64 cm, 95%CI 0.07 to 1.21, $P = 0.03$, 56 participants). However, no difference was found in the other 3 trials between cupping therapy combined with exercise and exercise alone on pain reduction in either the meta-analysis (difference of VAS, MD 0.16 cm, 95%CI −0.54 to 0.87, $P = 0.65$, I2 = 28%, random effect model, 2 trials, 82 participants)[20,31] or in the other two single trials (VAS, MD −0.53 cm, 95%CI −1.18 to 0.12, $P = 0.11$, 56 participants; NRS, MD −0.16 cm, 95%CI −1.32 to 1.00, $P = 0.79$, 32 participants).[20,25]

Safety assessment of cupping therapy

Of the 16 included trials, adverse events were mentioned in 10 trials.[17,20−24,26,27,29,30] Four trials reported that there was no adverse event among cupping groups.[20,26,29,30] Mild to moderate adverse events were reported in the remaining 6 trials,[17,21−24,27] with 10.3% of participants reporting hematoma at the treated site, 10.3% participants reporting increased pain in the original location after cupping or pain at the treated area, and 7.5% participants reporting muscle soreness or tingling in the original site of pain after treatment. No severe adverse event related to cupping therapy was reported in any of the 10 included trials.

Discussion

Summary of main results

From our review of 16 trials involving 921 participants we observed that cupping therapy reduces pain intensity in chronic or acute pain. Due to potential clinical and/or statistical heterogeneity, only 4 meta-analyses (with two trials in each) could be conducted. Compared to wait-list group or heat therapy, cupping therapy showed better effectiveness for pain reduction based on pain intensity measurements after treatment. Wet cupping combined with acupuncture also showed better effect on post-treatment pain intensity than acupuncture alone. No changes in pain intensity were evident when cupping combined with exercise was compared with exercise alone. Results from other single studies showed a potential benefit of cupping therapy compared with conventional medications and usual care.

Ten trials reported outcomes on safety issues. Hematoma and pain at the treated site or increased pain or tingling was mentioned as mild adverse events of cupping therapy among about 10% patients.

Quality of evidence

None of the 16 included trials blinded participants or practitioners, most likely resulting in performance bias. Valid placebo controls are difficult to apply for manual interventions, such as acupuncture and cupping, due to the unique technique applied by the practitioner and sensations experienced by subjects during treatment. Considering the difficulty of blinding practitioners and participants in cupping studies, the overall quality of 6 included trials were defined as "low risk of bias," in which only performance bias was unavoidable.

Findings of this review suggest that cupping therapy reduces pain intensity based on participant self-reporting. VAS scores were reduced an average 2 cm compared with control. Quality of evidence for pain relief varied from "moderate" to "high" among comparisons between cupping and wait-list control, conventional drugs, or other treatments (Summary of Findings tables in Supplemental Information). However, due to the fact that only trials with small sample sizes were available and that there were potential risks of bias (based on methodological quality assessment) within the included studies, combination of cupping therapy and other treatments compared with other treatments alone showed "low" evidence of benefit.

Potential bias/limitations of the review

As predefined, we only searched Chinese and English databases. However, cupping therapy is also commonly used in other Asian countries, such as Japan and Korea. In this review, one half of the included trials were retrieved from the Chinese literature, which may have introduced potential selection bias, thus limiting external generalization of the evidence.

Second, though statistical heterogeneity among trials within meta-analysis was not significant, characteristics of included participants were different in types of original diseases/conditions and even in details of interventions (point selection, treatment frequency, and treatment duration). Due to the limited number of included trials, subgroup analysis could not be conducted for further assessment.

Comparison with previous reviews

Kim's review published in 2011,[12] found 6 of 7 trials showed cupping had a positive effect for low back pain, cancer

pain, trigeminal neuralgia, and brachialgia paraesthetica nocturna compared with usual care, anticancer drugs, analgesics, or heat therapy. Only one trial failed to find superior effects of cupping on herpes zoster pain compared with medication. However, due to the poor quality of most of the trials, valid conclusions could not be drawn.

Our review was restricted to trials that clearly described randomization methods and included participants with moderate intensity pain at baseline. Five of the 7 trials in Kim's review did not meet these criteria, and therefore they were not included in our review. Kim's review included published studies through January 2009. In comparison, our review completed at the end of 2013 provides the latest evidence with 14 additional trials. We found that in the majority of trials, cupping therapy appeared to have a positive effect on pain, especially when compared with wait-list controls, usual care, conventional medications, or heat therapy. Thus, level of evidence was "moderate" to "high" for these comparisons.

Implications for practice

Our review found at least moderate evidence that cupping is more efficacious than no treatment or other treatments (such as heat therapy, usual care, and conventional medications) in reducing pain over the short-term (within 4 weeks). However, the limited number of trials deterred us from conducting subgroup analyses to validate specific effects of cupping in terms of category of pain (chronic or acute). Interestingly, our review did find that wet cupping, mainly on *ashi* points, was the most commonly used method (68.75% trials) for treating pain, presumably because there is empirical evidence of its effectiveness.

Adverse effects resulting from cupping are related to ecchymoses (which typically resolve within several days), swelling, and/or burns in some cases.[6] In our review, 10.34% of the included trials reported ecchymoses at sites of treatment as a mild adverse event with lesions fading within 2—5 days after treatment. Ecchymoses is regarded as normal reaction after cupping which will automatically disappear in a few days, and there is no need for any treatment.[32] According to TCM, ecchymoses presents better qi and blood circulation, and some studies report better effectiveness of cupping when ecchymoses happens.[33—35] Other mild adverse events reported were increased pain or tingling. As there is no systematic evidence available on the safety of cupping therapy as a guide, practitioners should remain vigilant of the time cups are retained on the skin and the strength of the suction to avoid these adverse events.

Implications for research

Seven of the 16 included trials provided access information to their registered protocols, allowing us to retrieve additional information. Authors are encouraged to register their study protocols before trial implementation to ensure a high standard of research is maintained so that valid conclusions can be reached.

Lack of blinding remains a major pitfall of conducting trials on traditional manual therapies, such as acupuncture and cupping. Attempts have been made to design sham placebo controls for cupping therapy,[36] though robust testing remains to be done. Researchers should therefore be aware of the potential high risk of performance bias due to the lack of appropriate blinding methods. Though blinding of participants and practitioners is difficult for studies on cupping therapy, blinding of outcome assessors and statisticians can still be undertaken.

Author contributions

Huijuan Cao participated in conception and design of the study, coordinated contributions from the co-authors, analysis and interpretation of data, draft and final approval of the manuscript. Jian-Ping Liu participated in the design of the study, critical revision and final approval of the manuscript. Xun Li acquired, analysis and interpretation of data, manuscript writing, and final approval of the manuscript. Xue Yan: acquired of data, critical revision and final approval the manuscript. Nissi S. Wang participated in conception and design of the study, critical revision and final approval the manuscript. Alan Bensoussan participated in conception and design of the study, critical revision and final approval the manuscript.

Competing interests

The authors declare that they have no competing interests.

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Appendix A. Supplementary data

Supplementary data related to this article can be found at http://dx.doi.org/10.1016/j.jtcms.2014.11.003.

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